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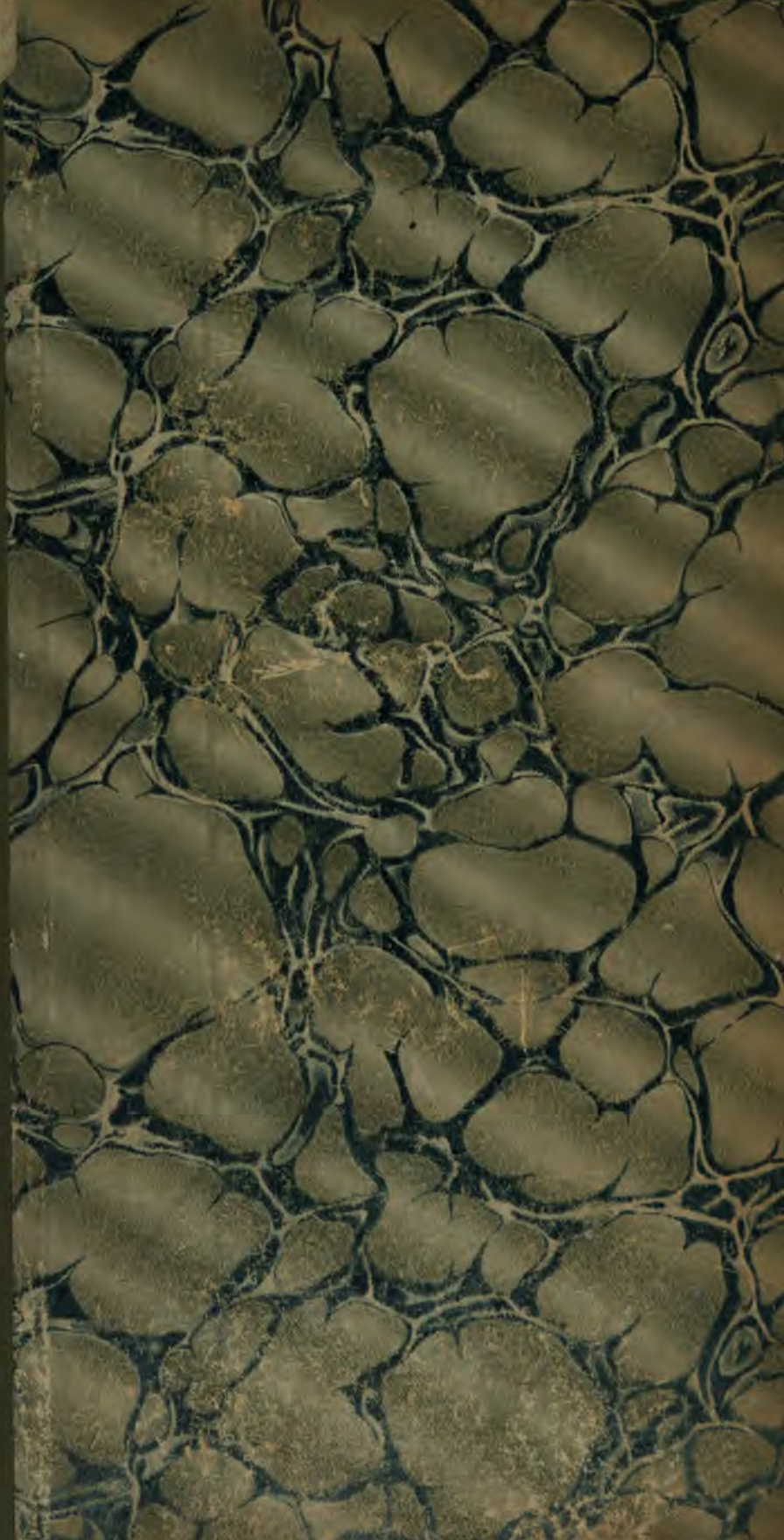
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Bowditch - The Growth of Children

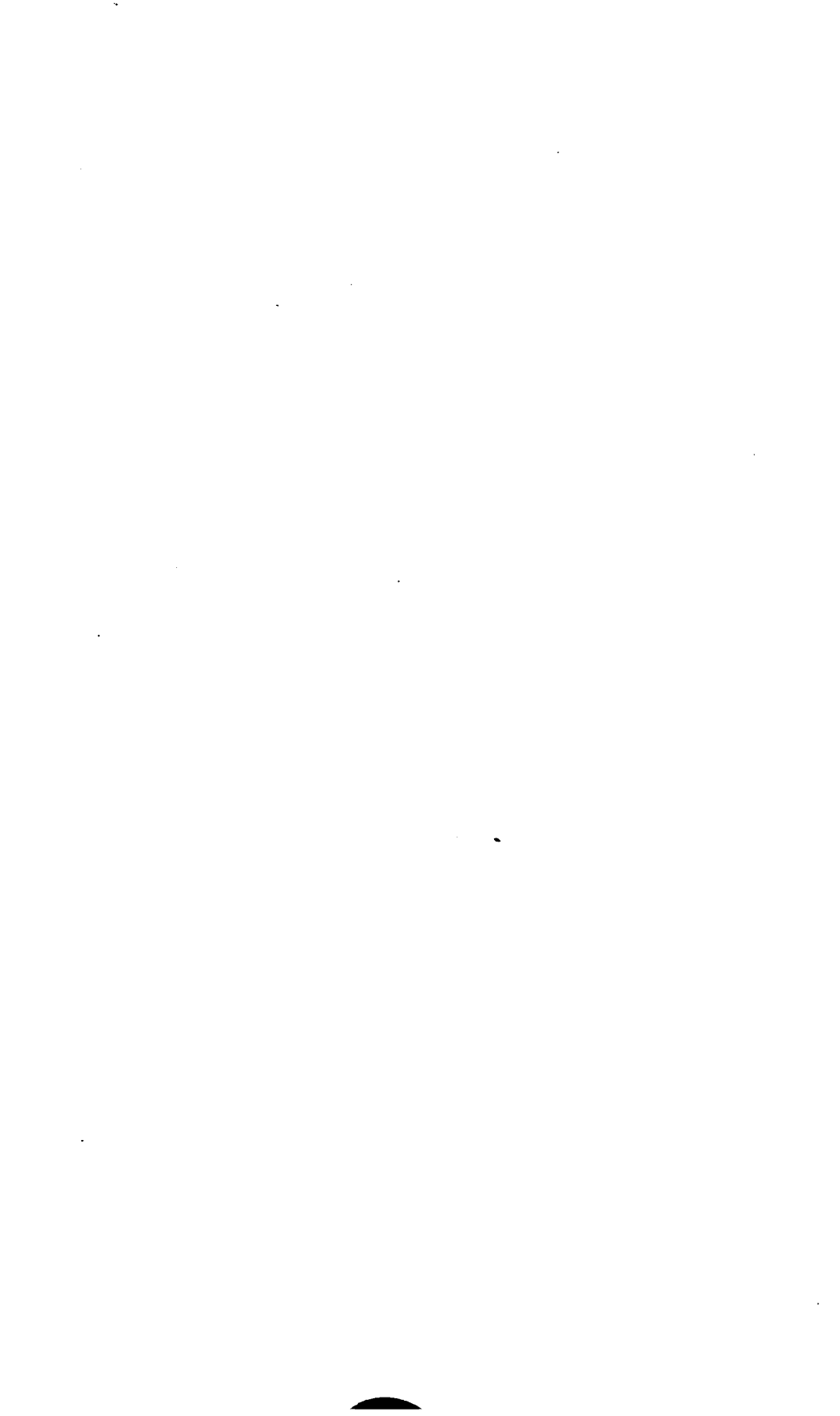


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THE
GROWTH OF CHILDREN.

(A SUPPLEMENTARY INVESTIGATION.)

WITH SUGGESTIONS IN REGARD TO METHODS
OF RESEARCH.

BY

H. P. BOWDITCH, M.D.,

PROFESSOR OF PHYSIOLOGY, HARVARD MEDICAL SCHOOL.



BOSTON:

Band, Aberg, & Co., Printers to the Commonwealth,
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[FROM THE TENTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH.]

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THE GROWTH OF CHILDREN:

(A SUPPLEMENTARY INVESTIGATION.)

THE RELATIVE IMPORTANCE OF MODE OF LIFE, AND OF RACE, IN DETERMINING THE SIZE OF GROWING CHILDREN.

IN an article on "The Growth of Children," published in the Eighth Annual Report of the State Board of Health, it was shown that in the public schools of Boston, children of American parentage are taller and heavier than children of the same age of Irish parentage. Reasons were also given for believing that this difference depends in part upon the greater degree of comfort which prevails in the homes of the former class of children, and in part upon differences of race or stock. The question of the relative importance of these agencies in bringing about the result was left undecided. An attempt has now been made to throw light upon the subject by tabulating the observations for each nationality, according to the *occupation of the parents*, as given in the records of the schools, and comparing together the averages of the various classes thus formed. The result of this additional study of the original data is given in the following pages.

The object being to ascertain whether differences of race or differences in the mode of life affect the rate of growth the more profoundly, it was important so to classify the observations that the occupations thrown together into a common class should be those of persons enjoying in about equal degree the comforts and luxuries of life. A perfectly unobjectionable classification of this sort, it is, of course, impossible to make, since persons described as following the same occupation may often have very different social positions. The term "paper-maker," for instance, may designate either the wealthy owner of numerous paper-mills, or one of the poorest of his employees.

The classification employed by Dr. Baxter¹ in his study of the effect of occupation on the liability to disease, seems, upon the whole, convenient and practical; and it has therefore been adopted, in its essential features, in this investigation.

The following table shows this writer's classification of occupations into four groups; viz., professional, mercantile, skilled, and unskilled labor. The second division of each group consists of occupations which are not mentioned in Dr. Baxter's classification, but which, being represented in the records of the Boston schools, have been assigned to the various classes as shown in the table.

TABLE NO. 1. — *Showing Dr. Baxter's Classification of Occupations.*

PROFESSIONAL.	MERCANTILE.	SKILLED LABOR.		UNSKILLED LABOR.
1 Architects.	1 Agents.	1 Bakers.	26 Paper makers and hangers.	1 Barkeepers.
2 Clergymen.	2 Brokers.	2 Barbers.	27 Photographers.	2 Boatmen.
3 Dentists.	3 Clerks.	3 Blacksmiths.	28 Plasterers.	3 Carters and drivers.
4 Druggists.	4 Grocers.	4 Bookbinders.	29 Plumbers.	4 Factory hands.
5 Editors.	5 Inn-keepers.	5 Brickmakers.	30 Printers.	5 Farmers.
6 Lawyers.	6 Liquor dealers.	6 Butchers.	31 Sailmakers.	6 Firemen.
7 Musicians.	7 Merchants.	7 Cabinet makers.	32 Shoemakers.	7 Fishermen.
8 Physicians.	8 Peddlers.	8 Carpenters.	33 Stone cutters.	8 Laborers.
9 Public officers.	9 Tobacconists.	9 Carriage makers.	34 Tailors.	9 Lumbermen.
10 Students.			35 Tanners and curriers.	10 Miners.
11 Teachers.	1 Book-keepers.	10 Cooks.	36 Telegraph operators.	11 Ostlers.
	2 Caterers.	11 Coppersmiths.	37 Tinsmiths.	12 Porters.
1 Actors.	3 Collectors.	12 Distillers.	38 Upholsterers.	13 Railroad men.
2 Army or navy officers.	4 Contractors.	13 Engineers.		14 Sailors.
3 Civil engineers.	5 Cotton samplers.	14 Engravers.		15 Soldiers.
4 Surveyors.	6 Detectives.	15 Gun and lock smiths.		16 Servants.
	7 Railroad superintendents.	16 Harness makers.	1 Bridge superintendents.	17 Watchmen.
	8 Salesmen.	17 Hatters.	2 Conductors.	1 Expressmen.
	9 Sea captains.	18 Iron workers.	3 Foremen.	2 Jobbers.
	10 Undertakers.	19 Jewellers.	4 Inspectors.	3 Pavers.
	11 Weighers.	20 Machinists.	5 Letter carriers.	4 Puddlers.
		21 Manufacturers.	6 Moulders.	5 Whitewashers.
		22 Masons.	7 Packers.	
		23 Mechanics.	8 Policemen.	
		24 Millers.	9 Stable superintendent.	
		25 Painters.		

¹ Statistics, Medical and Anthropological, of the Provost-Marshall-General's Bureau. By J. H. Baxter, A.M., M.D. In two volumes. Washington, 1875.

The original observations furnished by the principals of the schools were tabulated in accordance with this classification, and the average heights and weights calculated for each of the four classes of occupations. The result of this calculation, expressed both in the English and the metric system, is given in tables 2, 3, 4, and 5. It will be noticed that the only nationalities represented in these tables are the American and the Irish. Observations on children of parents of any other single nationality were not found to be numerous enough to warrant a distribution of them in accordance with occupation. All such observations were, however, thrown together into a single group of unclassified nationalities, and the average heights and weights calculated for the various occupations in the same way as for the American and Irish groups; but, since the figures thus obtained did not seem to throw any additional light on the question under consideration, it was not thought desirable to present them in print.

An examination of these tables shows that while in general the children of the professional and mercantile classes are larger than those of the laboring classes, yet no very exact gradation of size, corresponding to grades in the social scale, can be observed. On the contrary, it will be noticed that the children of parents engaged in unskilled labor are not infrequently larger than those whose parents are skilled laborers. This is particularly noticeable in the case of boys of Irish parentage. Here it will be seen, that, at nearly every age at which the observations are sufficiently numerous to justify a conclusion, the weight of the children of unskilled laborers is greater than that of the sons of skilled workmen. This fact is rendered evident by the curves given on Plate I.¹

Since the number of observations, in many of the groups in these tables, is too small to eliminate from the averages the effect of individual peculiarities, larger groups have been formed by uniting the professional and mercantile occupations into a "non-laboring," and the skilled and unskilled

¹ In this and all the following plates the ordinates of the curves represent the heights and weights corresponding to the various ages expressed on the line of abscissas. The upper curves show, in every instance, heights in inches, as indicated by the column of figures on the left; and the lower curves, weights in pounds, indicated by the column of figures on the right of the plate. The figures at the bottom of the plate show, for each age, the number of observations from which the averages were computed.

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TABLE NO. 3. — *Showing Average Weights (in ordinary dress) of Boston School Boys.*
PARENTAGE AMERICAN.

AGE AT LAST BIRTHDAY.	OCCUPATION OF PARENTS.											
	PROFESSIONAL.			MERCHANTILE.			SKILLED LABOR.			UNSKILLED LABOR.		
	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.
Five . . .	10	41.97	19.04	52	41.33	18.75	88	40.63	18.45	47	41.35	18.76
Six . . .	19	44.63	20.24	100	45.79	20.77	149	45.14	20.47	67	44.09	20.00
Seven . . .	31	50.82	23.05	110	49.76	22.57	147	48.91	22.19	71	49.47	22.44
Eight . . .	27	56.51	25.63	117	54.56	24.75	166	53.40	24.22	80	54.83	24.87
Nine . . .	22	62.54	28.37	108	60.80	27.58	165	60.08	27.25	74	59.19	26.85
Ten . . .	30	65.71	29.80	109	66.15	30.00	138	65.96	29.92	57	67.39	30.56
Eleven . . .	33	74.87	33.96	121	73.09	33.15	136	71.81	32.67	49	71.76	32.55
Twelve . . .	39	83.93	38.07	126	82.03	37.20	144	77.54	35.17	33	77.40	35.10
Thirteen . . .	49	90.76	41.16	121	90.03	40.83	139	85.85	38.94	48	89.15	40.43
Fourteen . . .	33	101.94	46.24	148	99.15	44.97	135	98.69	44.76	37	96.64	43.83
Fifteen . . .	33	109.94	49.86	126	110.75	50.23	112	109.41	49.62	37	103.74	47.05
Sixteen . . .	27	123.02	55.79	92	124.06	56.27	81	121.10	54.92	11	135.57	61.49
Seventeen . . .	23	129.37	58.67	47	129.12	58.56	38	128.56	58.31	5	129.04	58.52
Eighteen . . .	10	134.84	60.93	27	131.55	59.66	17	132.83	60.24	2	133.06	60.85

TABLE NO. 3. — Continued.
PARENTAGE IRISH.

AGE AT LAST BIRTHDAY.	OCCUPATION OF PARENTS.											
	PROFESSIONAL.			MERCANTILE.			SKILLED LABOR.			UNSKILLED LABOR.		
	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.
Five . . .	1	38.50	17.46	23	40.85	18.53	100	41.29	18.73	285	41.33	18.74
Six . . .	3	42.33	19.20	45	45.53	20.55	158	45.46	20.62	309	45.14	20.48
Seven . . .	1	43.50	19.73	40	49.58	22.49	219	47.98	21.76	336	49.57	22.48
Eight . . .	1	50.	22.68	51	55.11	25.00	209	53.44	24.24	329	54.31	24.63
Nine . . .	2	62.	28.12	46	59.05	26.78	186	58.58	26.57	306	59.04	26.78
Ten . . .	1	66.	29.93	43	67.40	30.57	181	63.26	28.69	323	65.50	29.71
Eleven . . .	2	67.50	30.61	43	69.96	31.74	195	69.27	31.42	285	69.61	31.57
Twelve . . .	2	75.12	34.07	35	77.92	35.34	161	74.71	33.89	281	76.12	34.53
Thirteen . . .	1	105.25	47.74	29	87.46	39.67	147	81.62	37.02	249	82.88	37.59
Fourteen . . .	3	78.91	36.24	33	88.28	40.04	103	90.48	41.04	176	91.79	41.63
Fifteen . . .	1	103.25	46.83	17	98.06	44.47	58	101.58	46.08	74	102.59	46.53
Sixteen . . .	-	-	-	14	116.62	52.90	23	111.82	50.72	20	117.03	53.08
Seventeen . . .	-	-	-	6	119.15	54.04	8	125.99	57.15	10	123.29	55.92
Eighteen . . .	-	-	-	3	152.16	69.01	1	145.	65.77	1	127.50	57.84

TABLE NO. 4. — *Showing Average Heights (without shoes) of Boston School Girls.*
PARENTAGE AMERICAN.

AGE AT LAST BIRTHDAY.	OCCUPATION OF PARENTS.											
	PROFESSIONAL			MERCANTILE			SKILLED LABOR.			UNSKILLED LABOR.		
	No. of Ob- servations.	Inches.	Centimeters.	No. of Ob- servations.	Inches.	Centimeters.	No. of Ob- servations.	Inches.	Centimeters.	No. of Ob- servations.	Inches.	Centimeters.
Five . . .	6	42.16	107.1	42	42.08	106.9	56	41.40	105.2	18	40.60	103.1
Six . . .	16	44.24	112.4	63	44.74	113.7	103	43.50	110.6	48	43.26	109.9
Seven . . .	21	45.04	114.4	114	46.22	117.5	139	45.95	116.8	60	45.68	116.1
Eight . . .	16	48.77	124.0	131	48.16	122.4	137	47.91	121.8	43	48.17	122.4
Nine . . .	15	50.20	127.6	95	49.78	126.5	148	49.40	125.5	45	49.39	125.5
Ten . . .	13	51.83	131.7	116	51.86	131.7	142	51.75	131.5	48	51.77	131.5
Eleven . . .	17	53.78	136.6	101	53.62	136.3	117	54.	137.2	41	53.05	134.8
Twelve . . .	19	55.48	140.9	113	56.77	144.2	115	56.68	144.	44	56.94	144.7
Thirteen . . .	20	60.02	152.4	87	58.90	149.6	141	58.68	149.1	35	58.31	148.2
Fourteen . . .	22	59.94	152.3	118	60.53	153.8	106	60.16	152.9	23	60.77	154.4
Fifteen . . .	31	61.77	157.	92	61.14	155.4	83	61.71	156.8	19	61.34	155.8
Sixteen . . .	18	61.22	155.6	95	61.56	156.4	74	61.60	156.5	19	62.12	157.9
Seventeen . . .	21	62.21	158.1	54	61.95	157.4	44	61.84	157.2	8	62.88	159.7
Eighteen . . .	15	62.94	159.9	50	62.27	158.2	26	61.48	156.2	2	61.85	157.2

TABLE NO. 4.—Continued.
PARENTAGE IRISH.

AGE AT LAST BIRTHDAY.	OCCUPATION OF PARENTS.											
	PROFESSIONAL.			MERCANTILE.			SKILLED LABOR.			UNSKILLED LABOR.		
	No. of Ob- servations.	Inches.	Centimeters.	No. of Ob- servations.	Inches.	Centimeters.	No. of Ob- servations.	Inches.	Centimeters.	No. of Ob- servations.	Inches.	Centimeters.
Five . . .	-	-	-	23	41.68	105.9	86	40.82	103.7	149	41.48	105.4
Six . . .	-	-	-	33	43.72	111.2	114	43.88	110.2	259	43.20	109.7
Seven . . .	1	44.60	113.3	33	45.33	115.2	139	45.16	114.7	262	45.43	115.4
Eight . . .	-	-	-	49	47.78	121.4	164	47.23	120.1	285	47.45	120.6
Nine . . .	-	-	-	27	49.05	126.9	140	49.45	125.6	273	49.21	125.1
Ten . . .	3	52.96	134.6	37	51.75	131.5	125	51.05	129.7	250	51.06	129.7
Eleven . . .	-	-	-	33	54.08	137.4	108	54.23	137.8	229	52.98	134.6
Twelve . . .	1	56.20	142.8	28	55.10	140.	99	55.50	141.	183	55.29	140.5
Thirteen . . .	-	-	-	28	57.50	146.1	79	57.49	146.	161	57.04	146.5
Fourteen . . .	-	-	-	31	60.16	152.9	61	59.39	150.6	99	59.74	151.8
Fifteen . . .	3	60.56	153.9	12	61.08	155.2	41	60.36	153.4	44	60.34	153.4
Sixteen . . .	-	-	-	14	61.47	156.2	13	61.01	155.	20	60.52	153.8
Seventeen . . .	1	62.80	159.6	2	60.80	154.5	9	61.72	156.9	4	63.60	161.6
Eighteen . . .	-	-	-	1	60.60	154.	3	60.50	153.8	1	64.80	164.7

TABLE No. 5. — *Showing Average Weights (in ordinary dress) of Boston School Girls.*
PARENTAGE AMERICAN.

AGE AT LAST BIRTHDAY.	OCCUPATION OF PARENTS.											
	PROFESSIONAL.			MERCANTILE.			SKILLED LABOR.			UNSKILLED LABOR.		
	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.
Five . . .	6	42.18	19.13	42	41.08	18.63	56	39.03	17.70	18	38.19	17.32
Six . . .	16	45.30	20.55	63	44.21	20.05	103	43.78	19.86	48	42.81	19.42
Seven . . .	21	47.60	21.59	114	48.83	22.15	139	47.96	21.75	60	47.06	21.35
Eight . . .	16	55.06	24.97	131	58.41	24.23	137	52.54	23.83	43	52.53	23.83
Nine . . .	15	61.34	27.82	95	58.07	26.34	148	56.56	25.65	45	57.33	26.01
Ten . . .	13	68.07	30.88	116	64.41	29.22	142	63.46	28.78	48	63.50	28.80
Eleven . . .	17	70.30	31.89	101	70.19	31.84	117	70.73	32.08	41	67.25	30.50
Twelve . . .	19	78.92	35.80	113	81.94	37.17	115	80.06	36.31	44	84.19	38.19
Thirteen . . .	20	99.14	44.97	87	90.36	40.99	141	91.13	41.34	35	87.79	39.82
Fourteen . . .	22	96.88	43.94	118	100.85	45.74	106	99.72	45.24	23	99.92	45.32
Fifteen . . .	31	109.91	49.85	92	107.86	48.92	83	106.29	49.12	19	113.68	51.56
Sixteen . . .	18	109.53	49.68	95	111.30	50.48	74	113.35	51.41	19	123.87	56.19
Seventeen . . .	21	120.28	54.53	54	114.75	52.05	44	114.15	51.78	8	120.85	54.82
Eighteen . . .	15	123.73	56.12	50	114.24	51.82	26	113.76	51.60	2	114.18	51.79

TABLE No. 5. — Continued.
PARENTAGE IRISH.

AGE AT LAST BIRTHDAY.	OCCUPATION OF PARENTS.											
	PROFESSIONAL.			MERCANTILE.			SKILLED LABOR.			UNSKILLED LABOR.		
	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.
Five . . .	-	-	-	23	41.32	18.75	86	39.24	17.80	149	39.87	18.08
Six . . .	-	-	-	33	44.05	19.98	114	43.40	19.69	259	43.04	19.53
Seven . . .	1	41.25	18.71	33	47.96	21.75	139	47.05	21.34	262	47.37	21.49
Eight . . .	-	-	-	49	53.05	24.06	164	51.25	23.25	285	51.84	23.51
Nine . . .	-	-	-	27	59.03	26.78	140	56.70	25.72	273	56.63	25.69
Ten . . .	3	64.66	29.33	37	63.55	28.83	125	60.20	27.31	250	61.92	28.09
Eleven . . .	-	-	-	33	71.58	32.47	108	67.91	30.80	229	66.97	30.38
Twelve . . .	1	100.00	45.36	28	75.02	34.03	99	75.06	34.05	183	76.35	34.63
Thirteen . . .	-	-	-	28	84.75	38.44	79	84.14	38.16	161	86.36	39.17
Fourteen . . .	-	-	-	31	98.61	44.73	61	96.73	43.88	99	95.78	43.44
Fifteen . . .	3	94.41	42.82	12	107.33	48.68	41	98.51	44.68	44	99.90	45.31
Sixteen . . .	-	-	-	14	110.62	50.18	13	110.73	50.23	20	103.47	46.93
Seventeen . . .	1	107.25	48.65	2	112.50	51.03	9	116.98	53.06	4	192.75	60.22
Eighteen . . .	-	-	-	1	98.50	44.68	3	104.58	47.40	1	111.50	50.57

TABLE No. 6. — *Showing Average Heights (without shoes) of Boston School Boys.*

PARENTAGE.

AGE AT LAST BIRTHDAY.	AMERICAN.						Irish.					
	NON-LABORING.			LABORING.			NON-LABORING.			LABORING.		
	No. of Ob- servations.	Inches.	Centimeters.	No. of Ob- servations.	Inches.	Centimeters.	No. of Ob- servations.	Inches.	Centimeters.	No. of Ob- servations.	Inches.	Centimeters.
Five . . .	62	41.94	106.5	135	41.71	106.0	24	40.98	104.1	335	41.59	105.6
Six . . .	119	44.46	113.	216	43.89	111.5	48	43.60	110.8	467	43.76	111.2
Seven . . .	141	46.59	118.4	218	45.99	116.9	41	46.03	117.	555	45.56	115.8
Eight . . .	144	48.53	123.4	246	47.98	121.8	52	47.60	121.	538	47.68	121.2
Nine . . .	130	50.37	128.	239	50.08	127.2	48	49.80	126.5	492	49.63	126.2
Ten . . .	139	52.35	133.	195	51.96	132.	44	51.78	131.5	504	51.55	131.
Eleven . . .	154	54.50	138.5	185	53.75	136.6	45	53.84	135.5	480	53.06	134.8
Twelve . . .	165	56.17	143.5	177	55.80	140.5	37	55.55	141.2	442	54.75	139.2
Thirteen . . .	170	58.54	148.8	187	57.83	147.	30	57.78	146.8	396	56.59	143.8
Fourteen . . .	181	61.30	155.8	172	60.83	155.4	36	58.36	148.3	279	58.71	149.2
Fifteen . . .	159	63.18	160.5	149	62.31	158.3	18	60.45	153.6	192	61.34	155.9
Sixteen . . .	119	65.49	166.4	92	65.54	166.5	14	65.23	165.8	43	63.67	161.8
Seventeen . . .	70	66.41	168.7	43	65.94	167.6	6	65.	165.1	18	66.32	168.5
Eighteen . . .	37	66.96	170.1	19	66.35	168.6	8	68.03	172.8	2	67.25	170.9

TABLE No. 7.—*Showing Average Weights (in ordinary dress) of Boston School Boys.*
PARENTAGE.

AGE AT LAST BIRTHDAY.	AMERICAN.						IRISH.					
	NON-LABORING.			LABORING.			NON-LABORING.			LABORING.		
	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.
Five . . .	62	41.43	18.79	135	40.91	18.57	24	40.75	18.48	885	41.82	18.74
Six . . .	119	45.61	20.74	216	44.81	20.83	48	45.33	20.56	467	45.25	20.52
Seven . . .	141	50.	22.68	218	49.09	22.27	41	49.43	22.42	555	48.94	22.20
Eight . . .	144	55.06	24.97	246	53.86	24.43	52	55.01	24.95	538	53.97	24.48
Nine . . .	130	61.09	27.71	239	59.81	27.13	48	59.17	26.84	492	58.87	26.70
Ten . . .	139	66.05	29.96	195	66.88	30.11	44	67.37	30.56	504	64.70	29.35
Eleven . . .	154	73.47	33.28	185	71.79	32.56	45	69.85	31.68	480	69.45	31.50
Twelve . . .	165	82.72	37.52	177	77.47	35.14	37	77.77	35.28	442	75.61	34.30
Thirteen . . .	170	90.24	40.93	187	86.70	39.33	30	88.05	39.94	396	82.41	37.38
Fourteen . . .	181	99.66	45.20	172	98.25	44.57	36	87.59	39.80	279	91.82	41.42
Fifteen . . .	159	110.58	50.16	149	108.	48.99	18	98.35	44.61	132	102.15	46.33
Sixteen . . .	119	123.82	56.16	92	122.83	55.71	14	116.62	52.90	43	114.24	51.82
Seventeen . . .	70	129.20	58.60	43	128.62	58.34	6	119.15	54.04	18	124.49	56.47
Eighteen . . .	37	132.30	60.01	19	132.86	60.26	3	152.16	69.02	2	136.25	61.80

TABLE No. 8. — Showing Average Height (without shoes) of Boston School Girls.

PARENTAGE.

AGE AT LAST BIRTHDAY.	AMERICAN.						Irish.					
	NON-LABORING.			LABORING.			NON-LABORING.			LABORING.		
	No. of Observations.	Inches.	Centimeters.	No. of Observations.	Inches.	Centimeters.	No. of Observations.	Inches.	Centimeters.	No. of Observations.	Inches.	Centimeters.
Five . . .	48	42.09	107.0	74	41.20	104.7	23	41.68	105.9	235	41.24	104.8
Six . . .	79	44.64	113.4	151	43.42	110.4	33	43.72	111.1	373	43.28	109.9
Seven . . .	135	46.03	117.0	199	45.86	116.6	34	45.31	115.2	401	45.84	115.2
Eight . . .	147	48.23	122.6	180	47.97	121.9	49	47.78	121.4	449	47.37	120.4
Nine . . .	110	49.84	126.7	193	49.40	125.5	27	49.95	126.9	413	49.29	125.2
Ten . . .	129	51.86	131.8	190	51.76	131.5	40	51.84	131.7	375	51.06	129.7
Eleven . . .	118	53.64	136.3	158	53.75	136.6	33	54.08	137.4	337	53.88	135.6
Twelve . . .	132	56.59	143.8	159	56.75	144.2	29	55.14	140.1	282	55.36	140.6
Thirteen . . .	107	59.10	150.2	176	58.80	148.9	28	57.50	146.1	240	57.59	146.8
Fourteen . . .	140	60.44	153.6	129	60.27	153.2	31	60.16	153.0	160	59.57	151.4
Fifteen . . .	123	61.30	155.7	102	61.64	156.7	15	60.98	154.9	85	60.35	153.4
Sixteen . . .	113	61.50	156.8	93	61.71	156.9	14	61.47	156.2	33	60.71	154.3
Seventeen . . .	75	62.02	157.6	52	62.00	157.5	3	61.46	156.2	13	62.30	155.7
Eighteen . . .	65	62.42	158.6	28	61.50	156.3	1	60.60	154.0	4	61.57	156.5

TABLE No. 9. — *Showing Average Weight (in ordinary dress) of Boston School Girls.*
PARENTAGE.

AGE AT LAST BIRTHDAY.	AMERICAN.						IRISH.					
	NON-LABORING.			LABORING.			NON-LABORING.			LABORING.		
	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.	No. of Ob- servations.	Pounds.	Kilograms.
Five . . .	48	41.22	18.69	74	38.83	17.61	23	41.32	18.74	235	39.04	17.98
Six . . .	79	44.43	20.15	151	43.47	19.72	83	44.05	19.98	373	43.15	19.57
Seven . . .	135	48.63	22.06	199	47.69	21.63	94	47.77	21.67	401	47.26	21.44
Eight . . .	147	53.59	24.31	180	52.54	23.83	49	53.05	24.06	449	51.62	23.41
Nine . . .	110	58.52	26.54	193	56.74	25.74	27	59.03	26.78	413	58.65	25.69
Ten . . .	129	64.78	29.38	190	63.47	28.79	40	63.64	28.87	375	61.35	27.83
Eleven . . .	118	70.20	32.58	153	69.83	31.67	33	71.58	32.47	337	67.27	30.51
Twelve . . .	132	81.51	36.97	159	81.20	36.83	29	75.98	34.46	282	75.89	34.42
Thirteen . . .	107	92.00	41.73	176	90.47	41.04	28	84.75	38.44	240	85.63	38.84
Fourteen . . .	140	100.23	45.46	129	99.75	45.24	31	98.61	44.73	160	96.14	43.61
Fifteen . . .	123	108.37	49.15	102	109.28	49.57	15	104.75	47.50	85	99.23	45.01
Sixteen . . .	113	111.02	50.36	93	115.50	52.39	14	110.62	50.17	33	106.33	48.23
Seventeen . . .	75	116.80	52.75	52	115.14	52.22.	3	110.75	50.24	13	121.83	55.26
Eighteen . . .	65	116.43	52.81	28	113.79	51.01	1	98.50	44.68	4	106.06	48.11

labor into a "laboring," group of occupations. The average heights and weights resulting from this classification are given in tables 6, 7, 8, and 9. Even in this grouping of the observations, the irregularities alluded to have not been entirely eliminated. Observations on children of Irish parents of the non-laboring classes are particularly few in number, a circumstance which introduces considerable uncertainty into conclusions which might otherwise be well established.

The conclusions to be drawn from an examination of these tables are indicated by the curves on Plates II.-IX. A glance at the curves on Plate II., for instance, shows at once that the sons of non-laboring American parents are, at almost all ages, both taller and heavier than the sons of laboring parents of the same nationality. Plate III. shows the same general fact for girls, though here the difference is much less striking than in the case of boys. It must not, however, be supposed that the superior size of the children of non-laboring American parents is *wholly* due to the fact that their growth takes place under conditions of greater comfort and luxury; for it is evident that among the parents recorded as American there must be a considerable number who, though themselves American, are the children of Irish parents, and it is also evident that this class will be relatively more numerous in the laboring than in the non-laboring population. Hence the smaller size of children of laboring American parents, as compared with those of the non-laboring classes of the same nationality, may be partly due to a larger admixture in the former class of children of American parentage, but of Irish extraction.

The curves on Plates IV. and V. show, in a similar way, for the Irish nationality, the superior size of children of the non-laboring classes; and here the result must evidently be due to differences in the mode of life, for there is no reason to suppose that any want of homogeneousness in the *race* will affect the non-laboring and the laboring classes in a different way. Unfortunately, the curves representing the growth of children of non-laboring Irish parents are rather irregular, owing to the small number of observations from which they are constructed; and the conclusions to be drawn from their examination are therefore somewhat less precise

than would have been the case, had the data been more numerous.

Some additional light may be thrown upon the question of the relative importance of race and mode of life in determining the rate of growth, by comparing together the children of different nationalities in the laboring and also in the non-laboring classes. The curves on Plates VI.-IX. show the result of this comparison. An examination of these curves in connection with those on Plates II.-V. shows that in general American children differ rather more from Irish children of the same social class, than children of the non-laboring classes differ from those of the laboring classes of the same nationality; in other words, race seems to be of somewhat more importance than mode of life in determining the rate of growth. This result confirms to a certain extent the conclusion reached by Boudin¹ from an examination of recruits to the army in different departments of France; viz., that stature is to a great extent "independent of comfort and misery, and is, on the contrary, closely connected with race." The same general fact seems to be also indicated by a comparison of the rates of growth of the children of the laboring and non-laboring classes, irrespective of their nationality. In Tables No. 10 and 11 are found the data necessary for this purpose, and on Plates X., XI., are given the results of the comparison. An examination of these curves in connection with those on Plates VI., VII., of the former article,² shows that, when the observations are grouped without reference to the occupation of the parents, American children differ more from Irish children, than the children of the non-laboring classes differ from those of the laboring classes when the observations are grouped irrespective of nationality.

Although the result of this investigation seems to show that mode of life, as indicated by the occupation of the parents, is less important than race in determining the rate of growth of children, yet there are several considerations which make it necessary to exercise a good deal of caution in accepting this conclusion as one of general application.

In the first place, it was shown in the former article on "The Growth of Children,"³ that, according to the figures

¹ See previous article, "The Growth of Children;" Board of Health Report, 1877, p. 292.

² Op. cit., p. 290.

³ Op. cit., table No. 20, Plate VIII.

TABLE NO. 11. — Showing Average Heights and Weights of Boston School Girls, irrespective of Nationality.

AGE AT LAST BIRTHDAY.		OCCUPATION OF PARENTS.									
		NON-LABORING.					LABORING.				
		Height.			Weight.		Height.			Weight.	
		No. of Ob- servations.	Inches.	Centimeters.	Pounds.	Kilograms.	No. of Ob- servations.	Inches.	Centimeters.	Pounds.	Kilograms.
Five .	.	120	41.66	105.9	40.55	18.39	491	41.26	104.8	39.48	17.91
Six .	.	172	44.12	112.1	44.14	20.02	809	43.24	109.9	43.18	19.56
Seven .	.	247	45.71	116.3	48.02	21.73	921	45.41	115.4	47.16	21.39
Eight .	.	297	47.92	121.8	52.79	23.94	982	47.47	120.6	51.81	23.50
Nine .	.	224	50.16	127.5	58.78	26.66	913	49.27	125.2	56.74	25.74
Ten .	.	232	51.66	131.3	63.76	28.92	854	51.25	130.8	61.98	28.11
Eleven .	.	210	53.66	136.4	70.49	31.97	719	53.41	135.7	68.01	30.85
Twelve .	.	237	56.16	142.7	80.18	36.37	671	55.70	141.5	77.52	35.16
Thirteen .	.	191	58.67	149.1	90.68	41.13	593	58.01	147.4	87.88	31.66
Fourteen .	.	226	60.28	153.2	99.40	45.09	419	59.84	152.1	97.92	44.42
Fifteen .	.	168	61.19	155.5	107.70	48.85	258	61.00	155.0	105.11	47.68
Sixteen .	.	147	61.46	156.2	111.22	50.44	169	61.55	156.5	112.59	51.97
Seventeen .	.	98	61.88	157.3	115.15	52.23	89	61.92	157.4	115.72	52.49
Eighteen .	.	77	62.26	158.2	115.83	52.54	46	61.70	156.8	112.94	51.23

furnished by Mr. Roberts, the sons of the English non-laboring classes are decidedly taller, and at most ages also heavier, than the children of the laboring classes, the difference in height amounting at thirteen years of age to upwards of four inches. The same fact is still more strikingly shown in the tables of a recently published work¹ by the same author. It is evident, therefore, that in England, where the population is comparatively stationary and homogeneous in character, the occupation of the parents has a very decided effect upon the size of growing children.

In the second place, it is evident that no grouping of occupations can possibly divide an American community into such distinct social classes as are to be found in English society. Hence the effect of mode of life on the growth of children, though it may not be less powerful in this country than in England, will not reveal itself so readily in statistical tables, owing to the difficulty of grouping the observations in a suitable way.

Although it appears, therefore, from this research, that the superiority in size of the children of the non-laboring over those of the laboring classes is much less marked in this country than in England, it does not necessarily follow, either that comfort and misery affect the growth of children less powerfully here than elsewhere, or that the difference is due wholly to the fact that the laboring classes in this country are better able to command the comforts and luxuries of life than the corresponding classes in England.

Taking these circumstances into consideration, it will probably be safe to conclude that the importance of mode of life, as a factor in determining the size of growing children in this community, is at least equal to, and possibly even greater than, that of race.

¹ A Manual of Anthropometry, by Charles Roberts, F.R.C.S. London, J. & A. Churchill, 1878.

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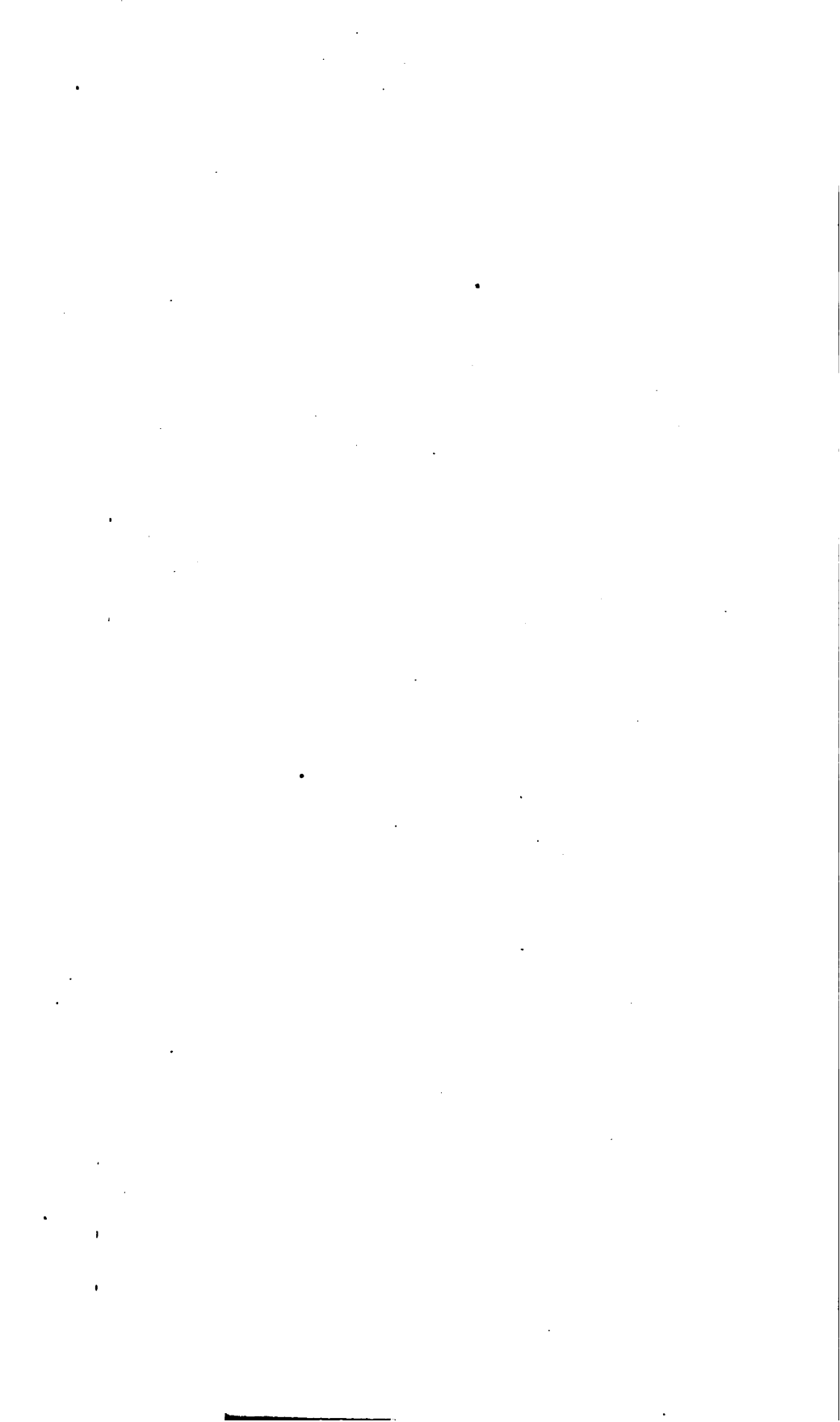
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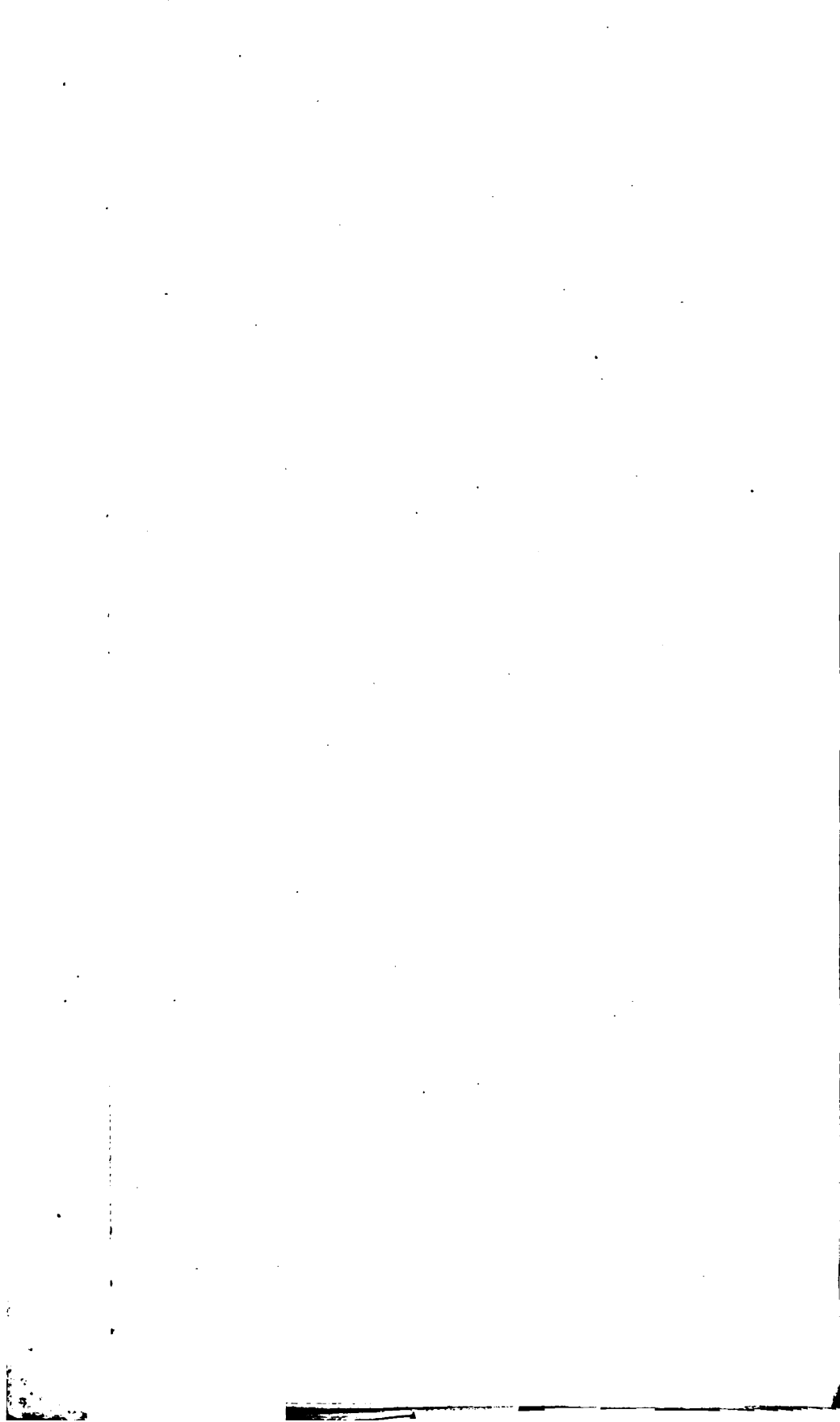
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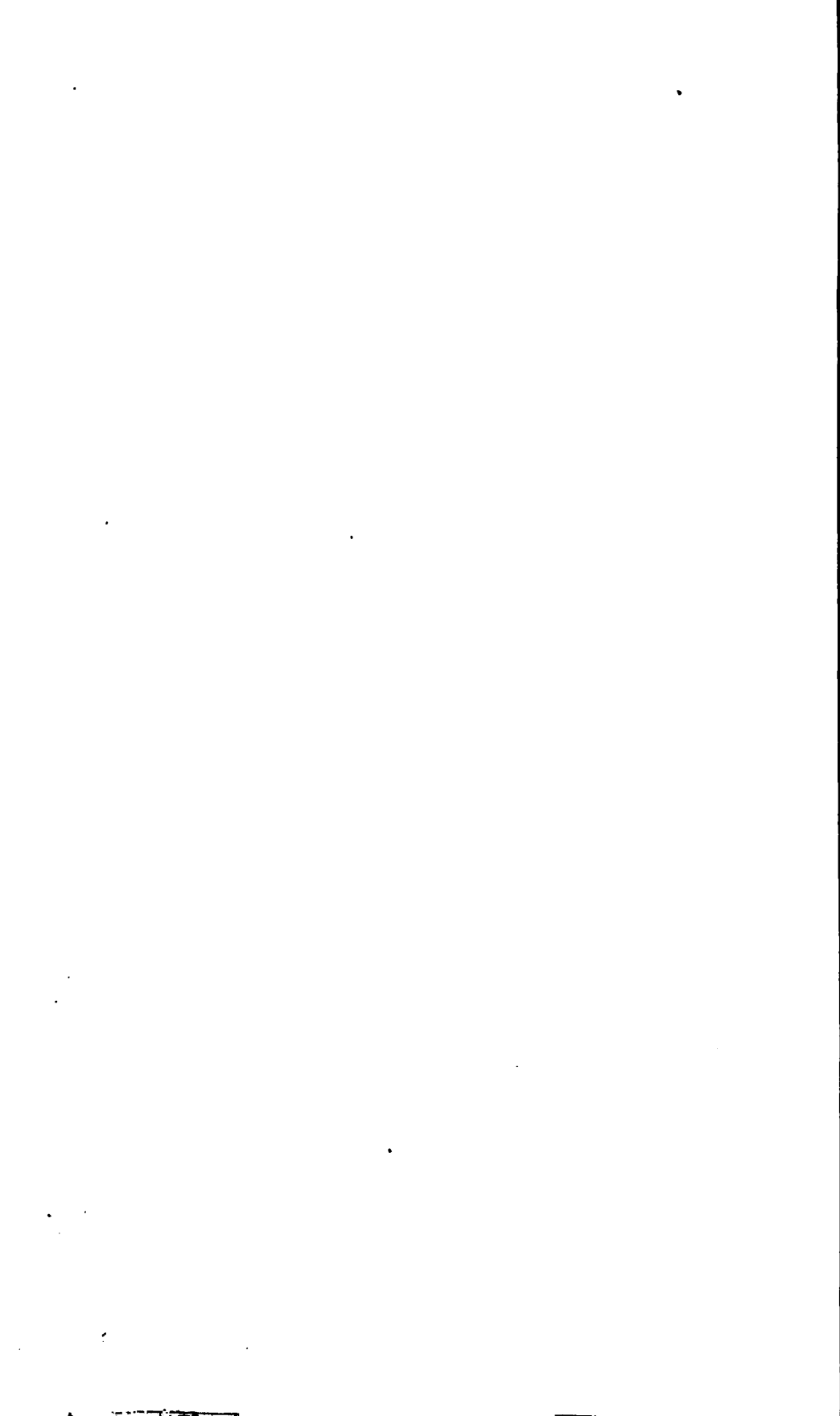
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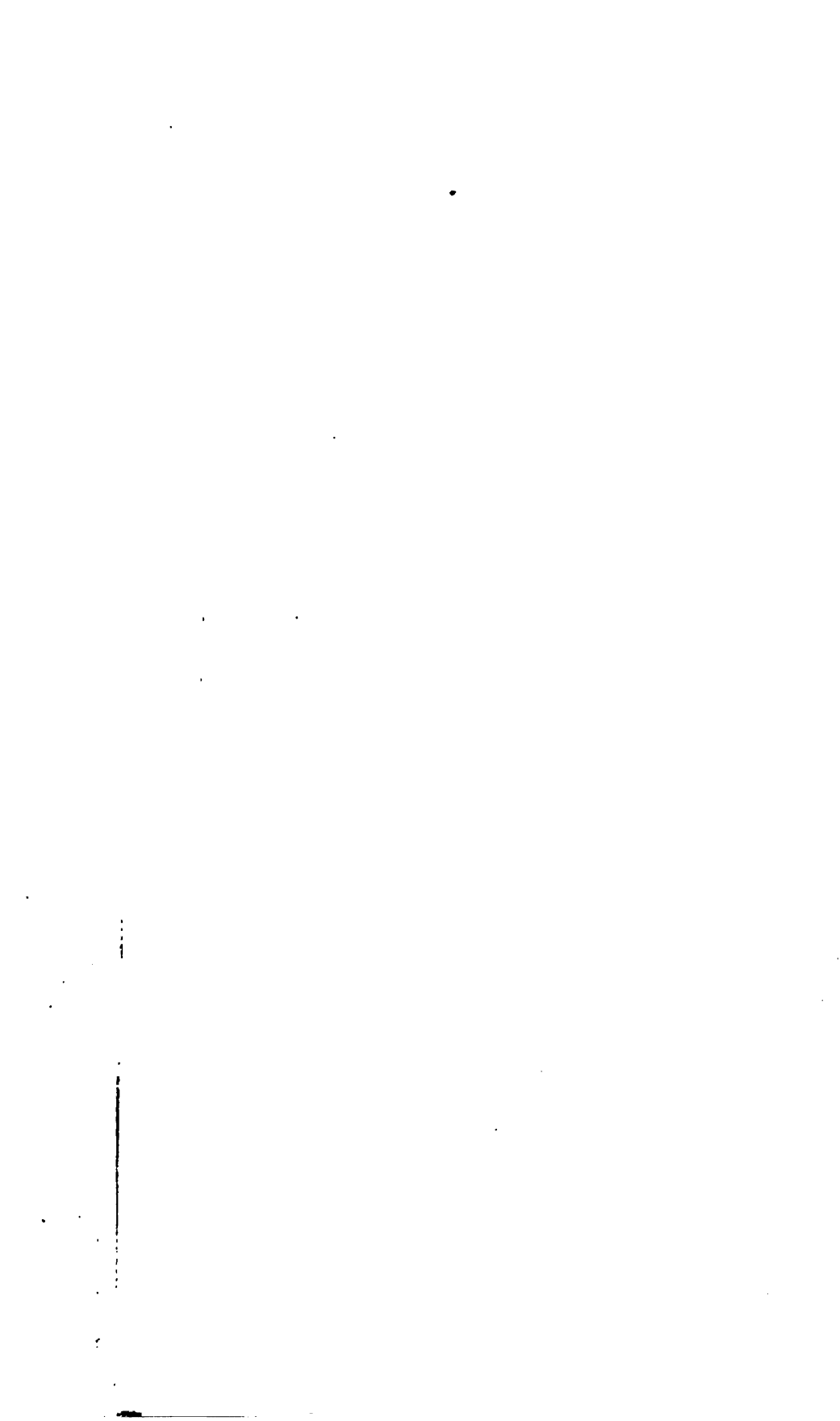


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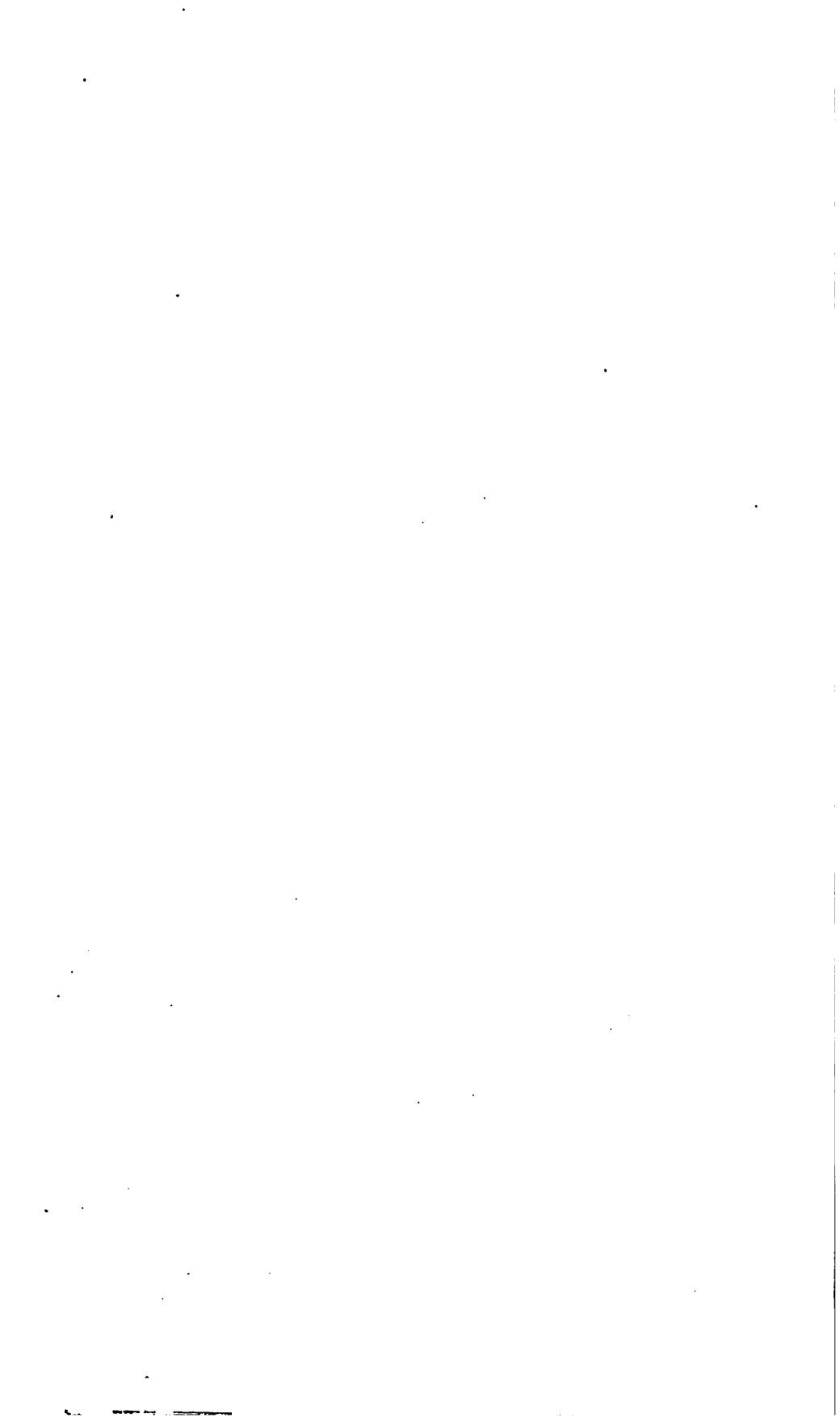
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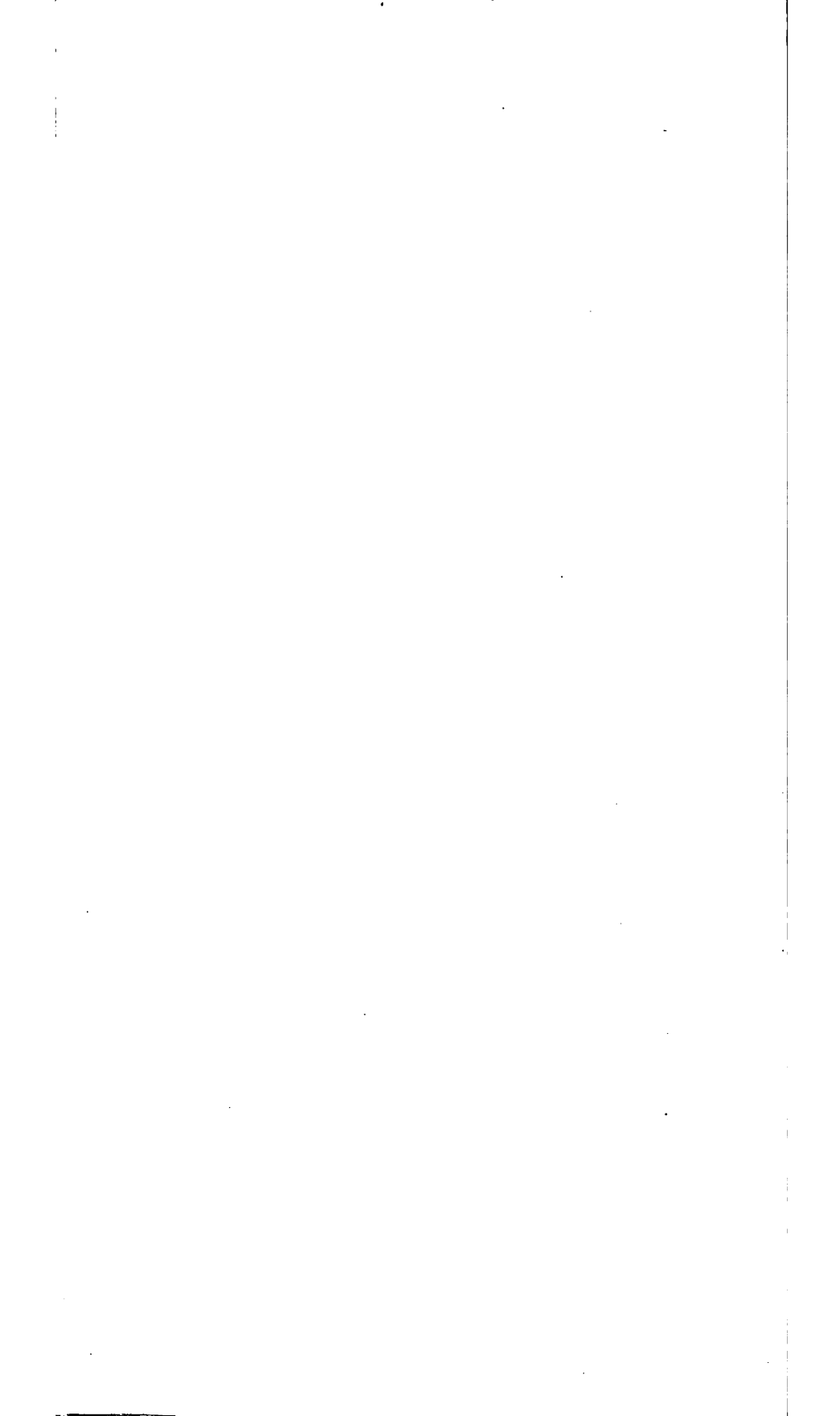
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ANTHROPOMETRICAL METHODS.

Since questions in anthropometry require for their solution the collation and comparison of observations which can be obtained in sufficient numbers only by the united efforts of many investigators, it is perhaps desirable to give in this connection a brief account of the most approved methods of research.

A systematic attempt to collect observations of this sort has been made in England. The Anthropometrical Committee of the British Association, 22 Albemarle Street, London, W., has published for distribution blank forms with columns headed as follows:—

NAME AND SURNAME. — (The initials will suffice.)

WHERE BORN. — (State parish and county.) If born abroad, state the name of the country.

RANK, PROFESSION, OR OCCUPATION.

RACE. — English, pure English, very pure English, Scotch, pure Scotch, very pure Scotch, or mixed Scotch and English, &c.

ORIGIN. — Countryfolk, pure countryfolk, very pure countryfolk, C. birth, T. since boy. Townfolk, pure townfolk, very pure townfolk, T. birth, C. since boy, &c.

SEX.

AGE, in years and months; years and twelfths.

HEIGHT, without shoes; in inches and eighths.

WEIGHT, when in ordinary in-door costume; in pounds, without shoes.

EYES. — Gray, light blue, blue, dark blue, light brown, brown, dark brown, green, black.

HAIR. — 1, Very fair; 2, fair; 3, golden; 4, red; 5, red brown; 6, light brown; 7, brown; 8, dark brown; 9, black brown; 10, black.

EXCEPTIONAL MEASUREMENTS.

CHEST. — Girth in inches and eighths. Breathing capacity in cubic inches.

STRENGTH OF ARM. — Drawing power in pounds.

SIGHT. — Test dots can be distinguished at how many feet and inches.

Each form is ruled for twenty sets of observations; and the following circular of instructions explains the object of the investigation, and the precautions to be observed in making the measurements.

GENERAL INSTRUCTIONS TO BE OBSERVED IN FILLING UP CERTAIN OF THE COLUMNS.

[As the object is to obtain a fair average, take care to exercise perfect impartiality of choice in the selection of cases.]

It is desirable, before beginning the measurements, that the various scales should be carefully verified. Accurate measurements with erroneous scales are much more misleading than off-hand measurements with correct scales.

Please write clearly.

Each sheet contains 20 lines, one line for each separate entry.

The return is required in order to inquire into physical differences under the following heads:—

1. Persons engaged in different occupations.
2. Persons bred and living in towns or country.
3. Natives of parts of the British Isles differing ethnologically, geologically, or in climate.
4. Boys and young men whose intellect and industry are above or below the average.
5. The general characteristics of men noted for athletic power.
6. The rate of growth in persons bred in town and country, and engaged in different occupations.

[Other topics of inquiry may hereafter be added.]

RACE.—By the phrase “purely English,” &c., it is understood that both the father and the mother were commonly reckoned as “English,” &c. In those cases where the history of all four grandparents is well known, and they were all reckoned to be of the same race, the entry may have the word “very” prefixed; thus, “very pure English,” &c.

ORIGIN.—If both the father and the mother had been commonly reckoned as countryfolk, from their own birth up to that of their children, the entry should be “purely countryfolk.” In cases where the history of all four grandparents is well known, and where they, *as well as* the parents, were all of them countryfolk in the sense just mentioned, the entry should have the word “very” prefixed; thus, “very pure countryfolk.”

Similar instructions to be observed as regards townfolk.

SEX.—It is proposed that the inquiry should, at first, be limited to males except for a few special objects.

AGE.—It is important that the age should be given in years and months (twelfths), both for children and adults.

HEIGHT.—To be given in inches and eighths.

WEIGHT.—To be given in *ordinary* in-door costume. Exceptionally thick boots, such as laborers wear, must be taken off.

EYES.—The entries should be of the form “light blue,” “dark blue,” or simply “blue” if the eye be neither dark nor light. The color of the iris should be viewed at such a distance that minor variations may blend into one general hue and tint. Thus green should be entered either as gray or blue, according to the prevalent appearance.

HAIR.—In addition to the colors mentioned in the column of the schedule, some other words may be adopted, such as sandy, yellow, auburn, chestnut. When the hair has begun to turn gray, the color it used to have should be given, with the word "formerly" prefixed; thus, "formerly black."

EXCEPTIONAL MEASUREMENTS.

These require more time and instrumental appliances than the foregoing: nevertheless it is hoped that they will be undertaken by many observers, on account of their value and interest.

GIRTH OF CHEST.—Make the person stand quite upright, with his shoulders back, and his arms hanging loosely by his side. The measurement must be taken next to the skin. The lower edge of the tape should touch the nipples, and the measurement should be read off in front. Care should be taken that the tape passes horizontally round the chest; because if the measurement is made obliquely, below the blade-bone, it will be erroneous. The person should be required to count 10 slowly during the operation, to prevent him from keeping his lungs over-inflated.

BREATHING CAPACITY.—Any good spirometer may be used. A convenient one consists of a graduated mackintosh cylindrical bag, much like the sleeve of a coat, closed at one end, and having a mouthpiece and a stop-cock at the other. (These spirometers are made by Coxeter & Son, surgical-instrument makers, 23 Grafton Street, East, Tottenham Court Road, London; price £1, 4s.) When using it, the air is entirely pressed out of the bag by rolling it up, then the stop-cock is closed. The person now takes it in his hand, prepares himself for a long breath, puts the mouthpiece to his mouth, opens the stop-cock, and breathes in. When the expiration is completed, he closes the stop-cock, and thus shuts up in the cylindrical bag the volume of air that it is desired to measure. To effect this, the mouthpiece is taken off, and laid transversely across the mouth end of the cylindrical bag; this is to be rolled up tightly round it, until the loose end of the cylinder becomes thoroughly tense from the included air; at that point the graduation marked on the bag is to be read off. (The breathing capacity is an important measure of vital energy, after the necessary corrections have been applied, with regard to the height and weight of the person observed.)

STRENGTH OF ARM.—It is proposed to measure the force that can be exerted by the arm when pulling (as an archer with a bow) in a horizontal direction, either against a graduated spring, or against a cord passing over a pulley and attached to a scale pan below, on which weights are placed. The right or left arm, whichever is the strongest, should be used to draw, and the other to resist. The resisting arm must be held straight, and the hand of the other arm brought back to the ear.

SIGHT.—This is to be measured by the distance at which the test-dots can be counted. Each test-dot is $\frac{1}{16}$ inch square. Cards of them can be had on application to the Secretary of the Anthropometric Com-

mittee. In making the measurement, a tape or other scale graduated to feet and inches must be fixed or hung horizontally, at a height of about 6 feet 3 inches above the ground. The person to be examined must stand under this, and the greatest distance must thereby be found at which he can clearly distinguish and count the dots. Hold the test-dot card perfectly upright in front of the person, and *let it face the light so as to be fully illuminated*. Expose some of the dots (not more than seven or eight at the time) by covering the remainder with a card or a piece of paper, and desire the person to name their number and relative positions. By using a covering card with a square portion cut out of one corner, six different groups of dots may be exposed without exceeding the number of dots above mentioned. Vary the groups frequently, to provide against deception. Keep the card of test-dots perfectly clean.

These forms, though intended particularly for use in Great Britain, may, with very slight modifications, be advantageously employed in similar researches in other countries.

For those engaged in anthropometrical investigations, the "Manual of Anthropometry," by Charles Roberts, F.R.C.S.,¹ will be found to contain much important information and many valuable suggestions. Accompanying the volume (and also to be obtained separately) is an elaborate chart giving instructions for making and recording a large number of measurements of various parts of the body, and containing a set of ruled co-ordinates for recording graphically the variations of any of the measurements at successive periods.

In this connection should also be mentioned a publication entitled "The Mother's Register,"² translated from the French of Professor J. B. Fonssagrives, and intended to encourage parents to record observations of various sorts on their growing children. Were such records extensively kept, a body of observation would soon be accumulated which would be of great value to the student of vital statistics.

In all statistical investigation, as soon as the observations become sufficiently numerous to give any great value to the conclusions to be drawn from them, the work of tabulating them so as to make these conclusions possible becomes extremely burdensome; and where very large bodies of figures are to be handled, as, for instance, the observations on more than half a million drafted men analyzed by Dr. Baxter, the magnitude of the work is such that it can be properly under-

¹ London, J. & A. Churchill, 1878.

² New York: The Nation Press, John Ross & Co., 1872.

taken only by a national government. Any device, therefore, by which this labor can be reduced to a minimum, will be welcome to those engaged in researches of this sort. This reduction can be best effected by a method extensively used in Germany, which consists in recording *on a separate piece of paper or card* all the observations made upon, and all the facts relating to, each individual case. To understand the advantages of this method, it will be well to consider how our study of the growth of children would have been modified, had it been conducted in accordance with this plan. Instead of collecting the observations on fifty or sixty children upon a single blank form headed as described on p. 277 of the former article (p. 5 of the reprint) the same facts would have been recorded for each child upon a separate card, printed somewhat as follows:—

Vital Statistics.

.....School for.....Boston,.....187 .

Name (or initials).....

Ageyearsmonths.

Height (without shoes) nearest centimeter.....

Weight (in ordinary clothes) nearest kilogram.....

Birthplace.....

Nationality { Father.....

of Parents { Mother.....

Occupation of Parents.....

Name (or initials) of observer.....

The handling of statistics collected in this way is exceedingly simple. If it is desired, for instance, to ascertain the height of boys of American parentage at different ages, the collected cards are to be sorted as follows:—

1. To separate the boys from the girls.
2. To separate the boys of American from those of foreign parentage.
3. To separate the boys of American parentage into groups corresponding to the different ages.

4. To subdivide these groups into smaller groups corresponding with each centimeter of height.

The number of cards in each of these smaller groups is then counted and recorded. By treating the observations of each age in this way, tables are obtained, like tables 4-15 of the former article, showing at a glance the distribution of all the observations taken, as well as the *mean* height for each age; i.e., the height on which the greatest number of observations fall; or, in other words, the height of the group containing the largest number of individuals. The *average* height for each age, which is not necessarily the same as the mean height,¹ is obtained by multiplying the number of observations in each group by the height of that group, adding together the products thus obtained, and dividing the sum by the total number of observations for each age.

As an illustration of this method, suppose the height of 1,000 boys of American parentage and five years of age to have been recorded at the nearest centimeter. If grouped in the manner above described, these observations will be found to be distributed somewhat as follows:—

Height. Nearest Cen- timeter.	No. of Observations.	Height X No. of Observa- tions.	Height Nearest Cen- timeter.	No. of Observations.	Height X No. of Observa- tions.	Height Nearest Cen- timeter.	No. of Observations.	Height X No. of Observa- tions.
91	2	182	101	52	5,252	111	38	4,218
92	4	368	102	68	6,936	112	26	2,912
93	5	465	103	77	7,931	113	18	2,034
94	7	658	104	83	8,632	114	14	1,596
95	9	855	105	87	9,135	115	11	1,265
96	10	960	106	90	9,540	116	9	1,044
97	12	1,164	107	88	9,416	117	6	702
98	17	1,666	108	80	8,640	118	3	354
99	25	2,475	109	67	7,303	119	2	238
100	34	3,400	110	55	6,050	120	1	120
Totals	1,000	105,511

In this table the first column shows the height in centimeters of the successive groups in which the observations are arranged; the figures in the second column indicate the number of individuals contained in each group; while the figures of the third column, being the product of those in

¹ For a discussion of the difference between averages and means, the reader is referred to Roberts's *Manual of Anthropometry*, p. 69.

the first and second, show the sum of the heights of all the individuals in each group. The sum total of all the figures in the third column, viz., 105,511, is therefore the sum of the heights of the 1,000 individuals measured; and this sum divided by the whole number of observations, viz., 1,000, gives 105.5 centimeters, the average height of boys of that age and nationality. The mean height, it will be noticed, is 106 centimeters.

It will be observed that the units of the metric system have been used in this description, in preference to those of the English tables. This has been done for two reasons. In the first place, the metric system is rapidly becoming the universal language of quantity throughout the civilized world, and its general adoption in this country cannot be much longer delayed. It is important therefore, that observations should be recorded in a form which will render them easily comparable with those which may hereafter be taken in similar investigations, as well as with those already taken in countries which enjoy the benefits of the metric weights and measures.

In the second place, it happens that for researches of this sort, the centimeter and the kilogram are much more convenient units than the inch and the pound; the inch being too large, and the pound being too small, to serve as a basis for forming successive groups of observations in the manner above described.

The advantages of this method of collecting and handling anthropometrical observations may be thus enumerated:—

I. *Saving of time in making the measurements.* Since the observations are distributed into groups differing from each other by successive centimeters or kilograms, the original measurements need be recorded with no greater accuracy than to the nearest centimeter or kilogram; and records of this sort can evidently be made much more rapidly than would be possible were greater precision required. Care must, of course, be taken to record those observations which fall about midway between two centimeters or kilograms, with the groups to which they really belong. For instance, all heights between 95.5 and 96.5 centimeters are to be recorded as 96; all between 96.5 and 97.5 centimeters, as 97 centimeters, &c.

II. *The work of tabulating is resolved into the sorting and*

counting of cards. All "intermediate tables" are thus done away with; the tables first constructed being those best adapted to display the results of the research.

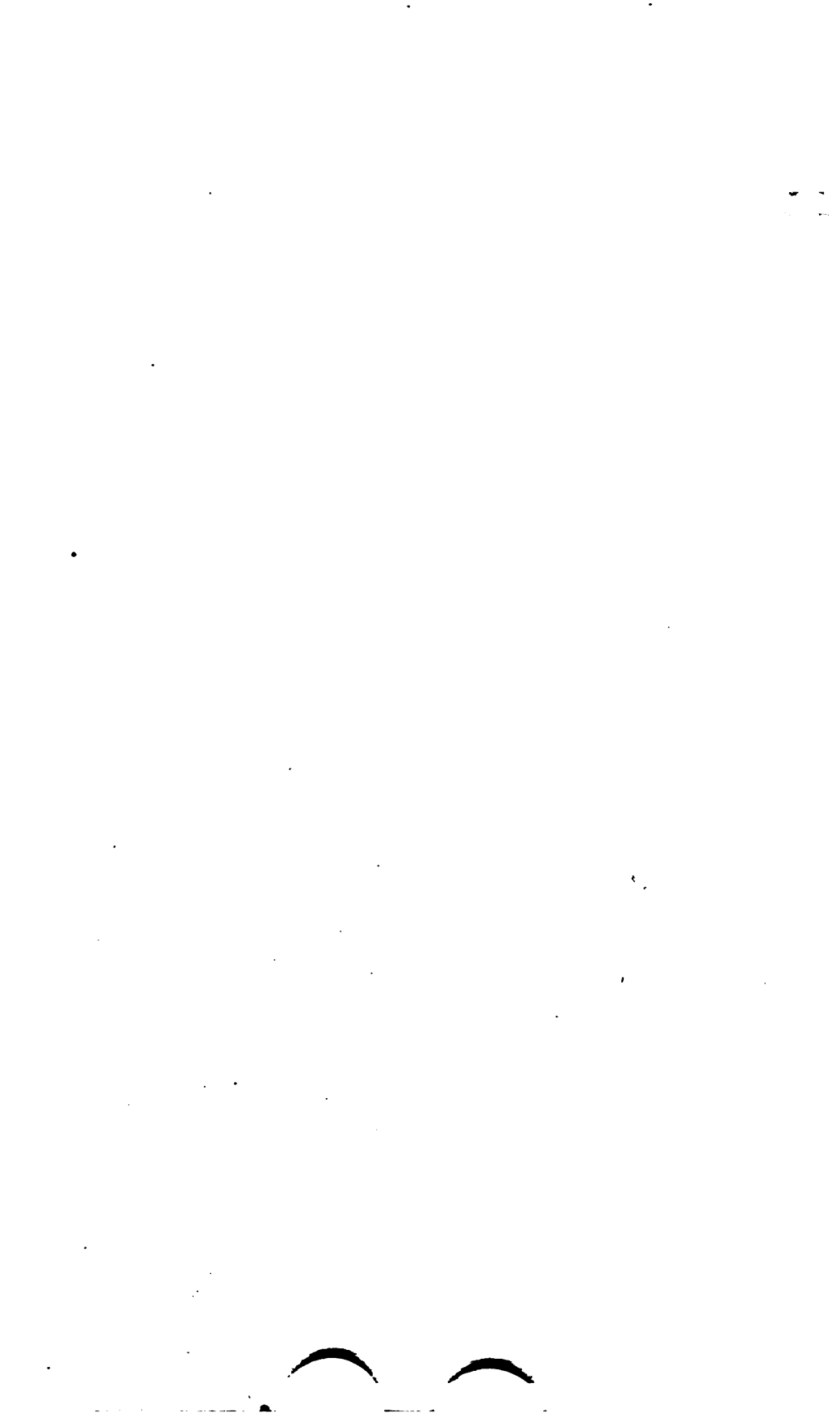
III. *Great saving of expense.* Though the use of a separate card for each individual observed necessitates more printing than the employment of large blank forms, yet the great saving of time and labor in tabulating the observations much more than compensates for the extra expense thus incurred.

IV. *The same set of observations may be used for the solution of a variety of questions.* Since the ways in which the cards may be sorted are only limited by the number of facts recorded upon them, it is evident, that, were this the generally adopted method of anthropometrical research, the observations of each investigator could, after serving the special purpose for which they were originally collected, be readily collated with other sets of statistics, and thus contribute to the solution of questions of a more general character.











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